Superfund Program Proposed Plan

Koppers Co., Inc. (Newport Plant) Superfund Site

Newport, Delaware

October 7, 2004

EPA Announces Cleanup Plan

The U.S. Environmental Protection Agency ("EPA") is issuing this Proposed Remedial Action Plan ("Proposed Plan") to present EPA's Preferred Remedial Alternative for addressing the contaminated soils, sediments and ground water at the Koppers Co., Inc. (Newport Plant) Superfund Site ("Koppers" or "Site") located in Newport, New Castle County, Delaware. The Site is along the Amtrak Northeast Corridor rail line, across White Clay Creek from Churchman's Marsh and next door to Ciba Specialty Chemical's (CibaSC's) Newport Plant (see Figure 1). EPA is requesting public comments on EPA's preferred alternative and the other alternatives for remediation of the contaminants present at the Site. The Proposed Plan also contains a glossary of some terms that may be unfamiliar to the general public. The terms in ***bold*** print in the text are available in the glossary at the back of the Proposed Plan.

Dates to Remember:

Oct. 7 to Nov. 6, 2004
Public comment period on cleanup options in Proposed Plan.

Oct. 21, 2004 - 7:00 P.M.
Public meeting at the Peniel United Methodist Church
115 E. Market Street
Newport, DE

Statement of the Preferred Cleanup Alternative

The preferred alternative addresses all contamination from the operation of the former Koppers wood-treating plant which resulted in significant creosote contamination in Hershey Run, in numerous wetland areas at the Site, in upland soils and in ground water. EPA's goals for this sitewide cleanup include protecting human health and the environment and restoring ground water to its beneficial use as a potential drinking water aquifer. The preferred alternative includes the consolidation of all contaminated soils and sediments into two on-site landfills or containment areas, collecting **non-aqueous phase liquid (NAPL)** contamination in the ground water and long-term monitoring of the **ground water**. The landfills would be located in the areas of the worst NAPL contamination and would include ground water barrier walls and collection systems to prevent the further migration of ground water contamination, including NAPL. One containment area would extend into the Hershey Run marsh, encompassing a portion of the existing channel and thereby requiring that part of the upper reach of

INSIDE:

Hershey Run be rechannelized. Wetlands would be created to replace any that are filled in as part of the landfill construction. Approximately 1.5 miles of Hershey Run would be dredged along with approximately 4 acres of wetlands. Soils from approximately 39 acres of uplands would be excavated with wetlands being created in some of these areas instead of backfilling. Smaller amounts of NAPL exist under several of the wetland areas that require cleanup. The NAPL material would be excavated, to the maximum extent practicable, when the wetlands are cleaned up.

The preferred cleanup for ground water is to excavate and consolidate the NAPL-contaminated material, with average excavation depths of 5 to 15 feet (ft), and isolated maximum depths of up to 30 ft. Site studies have shown the dissolved-phase ground water contamination is closely associated with NAPL contamination and has not migrated far. By containing and removing the NAPL contamination, ground water at the Site would be restored to its beneficial use (as a potential source of drinking water) outside of the containment area. New monitoring wells would be installed to augment the existing monitoring network. Although no contamination has been found in the Potomac aquifer, several new wells would be installed into the Potomac Aquifer in order to more closely monitor it. Ground water monitoring and sediment monitoring would be conducted to ensure the effectiveness of the barrier walls and landfill cap.

Finally, legal restrictions called "institutional controls" would be implemented to ensure that any future land use would not compromise the landfills, the barrier system, or the monitoring well network, and would prevent residential use and the installation of drinking water wells on the property. EPA believes that the preferred alternative identified in this Proposed Plan is the best alternative for addressing the entire Site and would allow the area to be used as a wetlands bank, a possible future land use being considered by the State of Delaware.[1] This alternative is further described on page 23.

Process

This Proposed Plan summarizes information found in the **Administrative Record** which contains the **Remedial Investigation,** Human Health and Ecological **Risk Assessments, Feasibility Study,** and other information which was used to develop the preferred alternative. If more in-depth information is needed, these documents can be referenced directly. EPA encourages the public to review these documents in order to gain a more comprehensive understanding of the Site and the Superfund activities that have been conducted there. The locations of the Administrative Record file for the Site and the address to send comments to regarding this Plan are given at the end of this Proposed Plan.

---

[1]Re-use options that have been brought to EPA's attention recently include the possibility of using this Site to construct wetlands to mitigate wetland losses from highway construction in the area. For example, the State of Delaware is planning to widen I-95 where it crosses Churchman's Marsh very close to the Site and this would require wetlands mitigation. There are also other highway projects in the area that the State is considering that would require wetlands mitigation. Considering the ecological setting of the Site, its size and extremely limited access, EPA considers the Site to be very suitable for such reuse once the Site has been remediated.

After the public comment period has ended and the comments received during the comment period have been reviewed and carefully considered, EPA, in consultation with the Delaware Department of Natural Resources and Environmental Control ("DNREC"), will select a final remedy for the Site. The final remedy will be described in a **Record of Decision ("ROD")**. The public's comments will be incorporated into a Responsiveness Summary contained in the ROD for the Site. Based on new information and/or comments received, the remedy selected in the ROD may be different from the preferred alternative identified here.

The Proposed Plan is being issued as part of EPA's public participation requirements under Section 117(a) of the **Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended ("CERCLA")** and Section 300.430(f)(2) of the **National Oil & Hazardous Substances Pollution Contingency Plan ("NCP")**.

Background Information

The following information is provided to explain the underlying situation in sufficient detail in order for the reader to understand the basis for EPA's decision.

The Former Koppers (Newport Plant) Superfund Site ("Koppers") is comprised of approximately 300 acres and is located in the northern part of New Castle County, in the State of Delaware, southwest of the Town of Newport and northwest of the Route I-95 and Route 141 interchange (Figure 1). To the north, the Site is bordered by high-speed railroad lines. Beyond the rail lines are a former municipal sewage treatment facility, an industrial property, and a residential area. To the east, the Site is bordered by the former DuPont Holly Run Plant and the Christina River. To the south and west, the Site is bordered by White Clay Creek and Hershey Run, respectively. To the west of the Site, across Hershey Run, lies the Bread and Cheese Island property.

This Site was proposed for the **National Priorities List ("NPL"),** which is a listing of the nation's most serious uncontrolled or abandoned hazardous waste sites, on October 26, 1989. The Site was formally added to the NPL on August 30, 1990, making it eligible for Federal cleanup funds.

In 1929, a group of parcels comprising the Site was conveyed by Lynam and Wright to the Delaware Wood Preserving Company, which began conducting wood-treatment operations on the property. In 1931, the Site was sold to Century Wood Preserving Company (Century). Four years later, in 1935, the Wood Preserving Company acquired the property and all associated stock from Century. Through liquidation of the Wood Preserving Company, Koppers Company acquired the Site in 1940, and reorganized in 1944 into Koppers Company, Inc. (Koppers). Koppers then continued wood-treatment operations at the Site until 1971, when the property was sold to DuPont. The Site has remained largely inactive since wood-treating operations ceased in 1971.

From 1974 to 1977, the New Castle County Department of Public Works leased the northern part of the Site, and then built and operated a wastewater treatment facility to temporarily maintain the County's wastewater treatment capabilities until permanent facilities were built. In 1977, the

County sold the building to DuPont and discontinued wastewater treatment operations at the Site.

The primary material used in the wood-treatment processes was a creosote/coal tar solution, which was used to preserve railroad ties, telephone poles, and other wood products (this is typical of the type of wood-treating used today for railroad ties and telephone poles). Although to a much smaller degree, pentachlorophenol (PCP) was also used to treat the wood. Throughout a large area of the Site (approximately two-thirds of the operations area), an array of railroad tracks provided for the movement of wood and materials to and from the Site. Based on available records, former Site areas where creosote handling occurred included the Process Area and Drip Track Area (Figure 2).

Located in the northwestern portion of the Site, the Process Area was utilized for the application of wood preservatives and contained various types of wood-treatment equipment and associated structures. This area also provided storage for approximately 1,000,000 gallons of creosote and other process-related materials. The treatment consisted of heating and pressurizing tanks filled with creosote and wood, forcing the creosote into the wood. After treatment, the freshly-treated wood products were temporarily allowed to cure and drip dry in the Drip Track Area prior to transfer to the Wood Storage Area. The Fire Pond was created as a source of water for fire-fighting purposes.

The Site was identified as a potential hazardous waste site in 1979. Following multiple subsequent investigations, the Site was proposed to the NPL in 1989, and formally listed on August 30, 1990. In 1991, Beazer East (the successor corporation to Koppers) and DuPont (the current land owner) signed an agreement with EPA to conduct the **Remedial Investigation/Feasibility Study (RI/FS)**.

<u>Site Characteristics</u>

Physical Structures

Existing facilities/structures and other physical features at the Site include one warehouse building (constructed by the New Castle Department of Public Works), a paved access road, and secondary roads providing access to overhead power lines that traverse the Site. Generally, the railroad lines once present at the Site no longer exist.

Access to the Site is restricted through the use of 24-hour security-guarded gates at the CibaSC facility, fencing, and posting. Natural barriers, such as the Christina River, White Clay Creek, and Hershey Run, and the surrounding marshes and wetlands also limit access to the Site, as does the high-speed Amtrak rail line to the north. However, signs of trespass, including spent shot gun shells, numerous hunting blinds and well-worn foot paths, have been found.

Geology

Figure 3 shows a geological cross section of the Site. Fill is the uppermost unit encountered in the uplands area, and varies in thickness from 0 to approximately 9 ft with greater thicknesses observed in the Process Area and Fire Pond Area. The fill is composed primarily of silts with lesser amounts of sands, gravels, and clays. In addition, the fill contains various anthropogenic materials including stone fill; brick and concrete fragments; asphalt pavement; railroad tie pieces; coal and ash debris; and wood, steel, and iron debris. In the former production areas of the Site, creosote is present within the fill, primarily in a dry, weathered form.

Fluvial Quaternary (Recent) sediments overlie much, if not all, of the unconsolidated Columbia Formation (Pleistocene). The Quaternary (Recent) sediments are generally comprised of silts with lesser amounts of sand, gravel, and clay as well as organic matter in the form of roots, peat, reeds, and other organic debris. These deposits range in thickness from 0 to upwards of approximately 10 to 15 ft and generally decrease in thickness near drainage areas. Holocene deposits are present in drainageways and marsh areas and consist of silty clay with lesser amounts of fine sand and thicknesses ranging from 0 to 6 ft. In the marsh areas a gray clay is present which is described as a drier and firmer clay at depth. This clay unit ranges in depth from 1 to 4 ft below ground surface (bgs), and its thickness ranges from 1 to 5 ft. This "marsh clay" is present in over 95 percent of the borings which were advanced below 2 ft or more in depth in the marsh areas. For the probes that penetrated through the gray clay layer, the thickness ranged from approximately 1 to 3 ft with an average thickness of approximately 2 ft. The marsh clay is apparently absent below sections of Hershey Run, or may be present at depths greater than that to which probes were advanced.

The Columbia Formation is composed of primarily silty sands and gravels with seams and thin beds (up to 2 ft in thickness) of silts. The Columbia Formation was encountered in thicknesses ranging from 0 ft to approximately 20 to 25 ft, and is generally thicker near the Process Area and Drip Track Area.

The Potomac Formation is composed of silts and clays interlayered with medium to fine sands. At the Site, a low-permeability layer is typically observed at the top of this unit and can vary from a clay to a clayey silt or clayey sand. There are no known areas of direct recharge from the Columbia to the lower Potomac at the Site. The Potomac Formation is distinguished from the Columbia Formation by smaller grain sizes and the presence of the low-permeability clay layer at the contact with the Columbia Formation. Where the entire thickness of the fine-grained units at the top of the Potomac were encountered, the thickness ranged from 1.3 to 5 ft (in seven borings). The fine-grained unit acts a low-permeability capillary barrier, retarding or preventing the downward movement of NAPL between the Columbia and Potomac Formation.

Hydrogeology

During high tides, ground water in the upper aquifer (which occurs in the Columbia and Fill geologic units) appears to be recharged by surface water in the West Central Drainageway and Hershey Run, and during low tides the upper aquifer appears to discharge ground water to the West Central Drainageway and Hershey Run. Horizontal hydraulic conductivities measured in the upper aquifer ranged from 2×10^{-1} to 4×10^{-4} cm/sec.

Using the highest horizontal hydraulic gradient observed in the upper aquifer (0.013 ft/ft), the mean hydraulic conductivity (3.2×10^{-2} cm/sec), and an assumed effective porosity of 0.3, an average linear ground water flow velocity of approximately 4 ft/day was calculated.

No drinking water wells are located within the Site boundaries. Local sources of drinking water include surface water from White Clay Creek (approximately one mile upstream) and municipal supply wells located within a few miles of the Site and screened in the Potomac aquifer.

Habitat

The Site consists of 163 acres of upland areas, 136 acres of wetlands and three ponds. Wildlife surveys were conducted at nine on-site locations (three forest, six field locations) and nine off-site locations (five forest, four field locations). Complete plant and animal species lists may be found in the Final Ecological Risk Assessment for the Site, available in the Administrative Record (EPA, 1997).

Three different upland cover types have been identified and mapped. These cover types include upland herbaceous "old field" (87 acres), upland scrub/shrub (14 acres) and upland forest (62 acres).

Wetlands cover approximately 45 percent of the Site and dominate the southern and western portions. The wetland cover types include freshwater tidal marsh (115 acres), non-tidal emergent wetlands (11 acres), non-tidal forested wetlands (9 acres), and non-tidal scrub/shrub wetlands (1 acre). Tidal wetlands at the Site individually drain into Hershey Run, White Clay Creek and the Christina River. Non-tidal wetlands occur in the South Ponds Area, K Area, Fire Pond Area, and approximately 15 smaller disjunct non-tidal wetlands occupy low-lying areas in the uplands of the Process and Wood Storage Areas.

White Clay Creek is Delaware's only "National Wild and Scenic River," a designation which is administered by the National Park Service (NPS) under the authority of the Wild and Scenic Rivers Act of 1968. The final reach of White Clay Creek, from the southern boundary of United Water Delaware Corporation's property (where the Amtrak lines cross the creek) to the confluence with the Christina River, is the nearest and adjacent section of the creek to hold this designation. EPA will work in consultation with the NPS in order to ensure that cleanup work at the Site does not negatively affect this reach.

Several plants which occur on Delaware's Rare Native Vascular Plant List exist at the Site. These plants include the swamp white oak, sessile leaved tick-trefoil, swamp milkweed, and closed gentian. While it is not expected that these plants will be impacted by the remedy, this will be evaluated in further detail during design work.

The Site may contain suitable habitat for the bog turtle, a federally endangered species. A survey to determine whether or not it is present will be conducted during the Remedial Design. The State has recently reported that a bald eagle was observed nesting on Bread and Cheese Island, adjacent to the Site.

Investigation Summary

An extensive remedial field investigation was conducted in three primary phases between 1994 and 1997, involving the collection and analysis of a substantial number of ground water, surface water, soils, sediments, air, and **biota** samples. The purpose of the Phase I field program, which was conducted from June 1994 through September 1995, was to characterize soil, ground water, sediment, surface water, air, and ecological and cultural resources to evaluate the overall environmental quality at the Process Area, Drip Track Area, Wood Storage Area, Fire Pond Area, K Area, South Ponds Area, wetlands, and upland areas (Figure 2). The purpose of the Phase II field program, which was conducted from February through October 1996, was to collect additional data on the lateral and vertical extent of contamination in soil, delineate surficial and subsurface areas containing NAPL, assess upgradient ground water quality, and evaluate the hydrogeological characteristics and geology of the Columbia Aquifer. The purpose of the Phase III field program, which was conducted from September 1996 to January 1997, was to collect additional data for the ecological **risk assessment** (ERA), including toxicity and **bioaccumulation** tests for soil and sediment.

A soil investigation was performed in which more than 700 soil samples were collected from over 500 locations across the Site. Observations were made of historical deposits of creosote-based non-aqueous-phase liquid (NAPL) material (typical of former wood-treating operations at the Site) in surface and subsurface soils. Creosote was encountered in various physical states at the Site.

Sediment investigations were also performed in the wetlands, ponds and riverine environments surrounding the Site. Approximately 500 sediment samples were collected from these areas and several off-site reference areas to characterize the nature and extent of NAPL and other contamination.

Hydrogeologic investigations were also performed at the Site. Twenty-six monitoring wells were installed to characterize ground water conditions and an additional 22 nearby residential and commercial water-supply wells were sampled. Approximately 300 ground water samples were collected in 5 sampling events, and analyzed for the presence of polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), metals, and dioxin/furans.

A surface water investigation was performed that involved the collection of approximately 180 surface water samples under a variety of conditions from nearly 50 on- and off-site locations to characterize local and regional water quality.

On-site observations and analytical measurements were made as part of an ecological investigation to characterize the diverse variety of plant and animal communities observed at the Site and to provide data necessary for completion of the human and ecological risk assessments for the Site. Included in these efforts was a comprehensive delineation of wetlands, extensive on- and off-site vegetative and wildlife surveys, and surveys of macroinvertebrate and fish populations. Laboratory tests were conducted on upland and aquatic species to measure the toxicity of the contamination present at the Site.

Ambient air quality was measured at 32 sampling locations across the Site during an air investigation.

A number of other field efforts were undertaken to identify the potential presence of underground piping and storage tanks. In addition, Phase IA and IB Cultural Resources Surveys were conducted to identify areas of potential archeological significance. A study was conducted in December 2002 to further characterize the clayey silt layer between the Columbia and the Potomac aquifers and the location of NAPL. An additional sediment/soil study in the Hershey Run and the West Central Drainage Areas was conducted in December 2002 and January 2003 to investigate the nature and extent of visible staining and PAHs at select sample locations.

Other studies, including toxicity studies, were conducted as part of the Remedial Investigation and are discussed below.

Nature and Extent of Contamination

The primary objective of the RI was to determine the nature and extent of contamination present at the Site and to determine what harm the contamination poses to human health or the environment. A number of types of contaminants were found at the Site, including PAHs, BTEX (benzene, toluene, ethylbenzene, and xylenes), other **VOCs**, **SVOCs**, pesticides, **PCBs**, metals, and dioxin/furans.

The extent of NAPL in surface soil, subsurface soil, and sediments was evaluated based primarily on visual observations recorded during the completion of approximately 240 soil borings and collection of over 150 sediment samples. Deposits of NAPL were observed in surficial soils of the Upland Area, primarily in the Process, Drip Track, and Wood Storage Areas (Figure 4). Other smaller deposits were observed along the access road leading to the southwest corner of the uplands and in the South Ponds and K Areas. In surface soils of these areas, creosote was found in a dry weathered form, typical of creosote NAPL and tar-like material that has been significantly weathered and dried over time. As a result, the material appeared to be immobile and it possessed little detectable odor. This dried weathered creosote looks similar to old roofing shingles or old roofing tar. The thickness of the larger deposits ranged from less than 6 inches to approximately 3 ft.

A number of potentially disjunct zones of NAPL were found in subsurface soils (Figure 5). These subsurface NAPL zones occur under portions of the Process Area, Drip Track Area, Wood Storage Area, and Fire Pond. Smaller zones are located near the South Ponds Area and K Area. NAPL in subsurface soils was observed primarily in a dry, weathered form or as immobile discontinuous blobs and small, thin seams. Although seams of NAPL-saturated soils were observed under the Process Area and Fire Pond, the zones did not appear to be continuous or interconnected. Based on the subsurface NAPL delineation methods presented in the RI, the areal extent of the individual NAPL zones ranged from approximately 2,400 square ft to 69,600 square ft (approximately 1.5 acres). Collectively, the subsurface NAPL zones sum to an areal extent of approximately 6.4 acres, and the volume of NAPL-containing material below the water table within the Columbia Formation is estimated to be approximately 82,000 cubic yards (cy). Ground water analytical data have shown that the creosote NAPL constituents are not migrating in ground water. This is consistent with the low solubilities of creosote and PAHs. Where constituents have been detected, borings have shown that NAPL is present in very close proximity. The plume exists in ground water only very near the NAPL itself, like a halo, and is quickly attenuated in only a short distance.

The extent and depth to which creosote contamination has impacted wetland sediments at the Site is shown in Figure 6. In surficial sediment (0-12 inches), NAPL was observed at numerous sampling locations, including samples from the Hershey Run Drainage Area and samples from the West Central Drainage Area. In subsurface sediments (below 12 inches), NAPL was observed at depths greater than 6 ft, but generally not throughout the whole depth of the sample. However, at location HRD-7R (Hershey Run, between the Fire Pond and power lines) NAPL was identified throughout the full length of the sediment core. More recent sampling, involving many transects throughout Hershey Run, has shown that NAPL or highly contaminated sediment is present throughout virtually the entire length of the Hershey Run channel at the Site.

For example, in the slope of the banks of Hershey Run in the vicinity of the Fire Pond, as well as between Hershey Run and the railroad tracks, there appears to be a large volume of NAPL in the subsurface that flows into surface water and sediments, even over thirty years since wood-treating operations at the Site ceased. In the channel of Hershey Run itself, NAPL has been observed streaming upward out of the sediments underfoot as a brown liquid, then spreading out as a significant surface layer of NAPL that covers the width of the stream, moving up- or downstream depending on the tide. The oily sheen on the water was observed as far back as 1980, suggesting that NAPL at the Site has remained mobile in the subsurface for many decades, and has been migrating to surface water for at least 24 years. State officials informed EPA that in the mid-1990s, they witnessed NAPL streaming out of the banks of the Site into Hershey Run, just from the pressure of their weight. This NAPL presents a hazard to ecological receptors (such as fish, water fowl, etc. which could be exposed to the material when sediment is disturbed), and has the potential to migrate off-site via the surface water. It may also present a hazard to individuals wading in the stream (e.g., hunters, anglers and trespassers). Recent surveys of fish tissue in Hershey Run conducted by USFWS and the State have shown unusually high rates of liver tumors in fish (approximately 40% incidence in mummichogs). During these sampling events, USFWS also observed the release of NAPL from Hershey Run sediments.

<u>Summary of Site Risks</u>

Human Health Risk Evaluation

A Baseline Risk Assessment was conducted in order to determine the current and potential future effects (if no cleanup actions were taken at the Site) of contaminants in sediments, soils and ground water on human health and the environment. The current and potential future land use plays a key role when EPA determines the exposure scenarios to be evaluated in the Baseline Risk Assessment. Although historically used for industrial purposes and currently zoned as industrial, the Site is currently not in use other than as wildlife habitat. The adjacent properties (the former DuPont Holly Run plant and the existing CibaSC facility) have both been used for industrial purposes throughout the history of the Site. Therefore, with regard to human health, EPA evaluated the potential risks associated with industrial use of the Site, construction workers, anglers, adolescent swimmers and adolescent trespassers. EPA does not believe the Site could reasonably be used for residential purposes because of the difficulty of access (through an active chemical plant) and the isolation of the property (surrounded by railroad tracks [Amtrak's Northeast Corridor line], water, and the active facility).

The Baseline Risk Assessment considered the hazards from potential exposure to contamination if an industrial facility were to be built at the Site. Potential effects were evaluated from the incidental ingestion of sediments and soils, ingestion of ground water contaminated with creosote constituents, dermal contact with Site sediments, soils and ground water, and the inhalation of vapors emitted from ground water were it to be used (i.e., for showering).

For carcinogenic risks, the Human Health Risk Assessment found that the risk for an industrial worker from ingestion and dermal exposure for soils was 2.4×10^{-4} for soils. The majority of the risk was caused by the incidental ingestion of soil (1.8×10^{-4}). The contaminant that contributed the most to the risk was benzo(a)pyrene, with other PAHs (including benzo(a)anthracene, benzo(b)fluoranthene, and dibenz(a,h)anthracene) also contributing.

For carginogenic risks from ground water, the risk from dermal exposure to a future industrial worker resulted in a cancer risk of 1.3×10^{-3} and the risk from ingestion resulted in a cancer risk of 4.6×10^{-1} (well in excess of EPA's maximum acceptable risk of 1 in 10,000). Scenarios evaluating exposure to ground water without NAPL present did not result in carcinogenic risk outside of the acceptable range.

For non-carcinogenic risks from ground water, the dermal scenario for a future industrial worker resulted in an **Hazard Index (HI)** of 115 (or 115 times greater than EPA's threshold). For the ingestion scenario, the risk calculation for a future industrial worker resulted in an HI of 170 (approximately 170 times greater than EPA's threshold). The risk to a future industrial worker where NAPL was not present in the ground water produced a Hazard Index (HI) of 1.3 when the dermal, ingestion, and inhalation pathways were combined. The HI exceedance of 1was largely caused by high background levels of metals that occur in Columbia Aquifer ground water, which contributed to the ingestion pathway.

There were no site-related contaminants found in the Potomac Aquifer wells at the Site, but these wells are not located in the vicinity of the worst areas of contamination.

In addition, EPA believes that the risk from exposure to soil and sediment may be underestimated. Due to the presence of creosote NAPL at the surface in both soils and sediments of the Site, there exists the potential for acute toxicity were a trespasser to be exposed to that material, as PAHs are a dermal irritant on contact.

In summary, it is concluded that there exist unacceptable risks to human health at the Site. In addition, there exists the potential risk of exposure to creosote material in soils and sediments for any person traversing the Site.

WHAT IS HUMAN HEALTH RISK AND HOW IS IT CALCULATED?

A Superfund human health risk assessment estimates the "baseline risk." This is an estimate of the likelihood of health problems occurring if no cleanup action were taken at a site. EPA consider two types of risk: cancer risk and non-cancer risk. The likelihood of any kind of cancer resulting from a Superfund site is generally expressed as an upper bound probability; for example, a "1 in 10,000 chance." In other words, for every 10,000 people that could be exposed, one extra cancer *may* occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than would normally be expected to from all other causes. For non-cancer health effects, EPA calculates a "hazard index." The key concept here is that a "threshold level" (measured usually as a hazard index of less than 1) exists below which non-cancer health effects are no longer predicted.

A four-step process is used to estimate the baseline risk at a Superfund site:

Step 1: Analyze Contamination
Step 2: Estimate Exposure
Step 3: Assess Potential Health Dangers
Step 4: Characterize Site Risk

In Step 1, EPA looks at the concentrations of contaminants found at a site as well as past scientific studies on the effects these contaminants have had on people (or animals, when human studies are unavailable). Comparisons between site-specific concentrations and concentrations reported in past studies enables EPA to determine which contaminants are most likely to pose the greatest threat to human health.

In Step 2, EPA considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure. Using this information, EPA calculates the "reasonable maximum exposure" (RME) scenario, which portrays the highest level of human exposure that could reasonably be expected to occur.

In Step 3, EPA uses the information from Step 2 combined with information on the toxicity of each chemical to assess potential health risks.

In Step 4, EPA determines whether site risks are great enough to potentially cause health problems for people at or near the Superfund site. The results of the three previous steps are combined, evaluated and summarized. EPA adds up the potential risks from the individual contaminants and exposure pathways and calculates a total site risk.

Ecological Risk Evaluation

Like a Human Health Risk Assessment, an Ecological Risk Assessment (ERA) serves to evaluate the potential for risks due to exposure to site contaminants specific to ecological receptors (such as wildlife, fish, and plants). Since the ERA evaluates many species which have drastically different exposure pathways, the ERA can appear complicated. Numerous environmental processes and ecological receptor groups (part of what is referred to as “assessment endpoints”) are evaluated, and there are differences in contaminant exposures and sensitivity to contaminants between groups. For example, wildlife are mainly exposed through their diet while soil organisms are exposed through direct contact with the soil in which they live. The complexity of the ERA arises from the need to evaluate the important exposure pathways to the relevant receptors. The toxicology varies between the different ecological groups. In addition, some contaminants are effectively transferred up the food chain, concentrating and thereby posing risks, while other contaminants are not transferred because they are either metabolized, biologically regulated or simply not absorbed.

Superfund site-specific ERAs are conducted using an eight step process which minimally consists of two tiers of evaluation: a Screening Level ERA ("SLERA" - steps 1 and 2) and the full Baseline ERA ("BERA" - steps 3 through 7). Step 8 is a risk management step. The function of the SLERA is to determine if a BERA is necessary, along with which contaminants should be evaluated further. A SLERA uses published conservative toxicity benchmarks found in literature for water, sediment and soil, and compares site concentrations to these benchmarks.

The BERA begins with the results of the SLERA and with problem formulation, which establishes the goals, breadth and focus of the investigation. It also establishes the assessment endpoints, which are the specific valued ecological communities to be protected. The questions and issues to be addressed in the BERA are defined based on potentially complete exposure pathways and ecological effects. A conceptual site model (CSM) is developed that includes questions about the assessment endpoints and the relationship between exposure and effects. The CSM describes the approach, types of data and analytical tools to be used for the analysis phase of the BERA. Information is generated through literature reviews and field studies, results are compiled and conclusions are reached. Once it has been concluded that there exists ecological risk, the information is used to meet other objectives, such as determining what exposure level may minimize any unacceptable risk.

A CSM relies on contaminant and habitat characteristics to identify critical exposure pathways to the selected measurement endpoints. A measurement endpoint is a measurable biological response to a stressor that can be related to the assessment endpoint. The CSM for the Koppers Site, for example, would illustrate that contaminants were spilled onto the ground in the past and have migrated overland and/or through the subsurface into the adjacent wetlands (i.e., Hershey Run and the Western Central Marsh adjacent to the South Ponds), where macroinvertebrates, insects, fish and other organisms may be exposed. The potential for risk exists where organisms are exposed to contamination directly (e.g., insect larvae living in contact with contaminated sediments, fish contacting contaminated sediments and/or earthworms and other burrowing organisms living in contact with soil), as well as when organisms higher in the food chain consume organisms lower in the food chain which have been in contact with contamination and have stored contamination in their bodies (e.g., insects may store contaminants, then fish eat the insects, birds eat the fish, and so on). The SLERA identified PAHs and other contaminants exceeding benchmarks in sediment, soil and water.

At the Koppers Site, a total of 12 assessment endpoints were evaluated, six related to direct exposure and six related to exposure to contamination through the food chain for non-aquatic receptors. Only the six related to direct exposure (see Table 1 below) identified risks associated with the creosote contamination. These conclusions are largely based upon the results of the site-specific toxicity tests conducted with Site sediment on the amphipod (a small shelled organism), *Hyalella azteca*, and the midge (a small fly), *Chironomus tentans*, and with Site soil on the earthworm, *Eisenia foetida*, as supplemented with plant community observations.

Table 1 - Assessment Endpoints

Assessment Endpoint	Lines of Evidence	Ecological Receptor	Weight of Evidence
1) Protection of the structure and function of wetland communities and 2) Protection of the aquatic benthic invertebrate communities structure and function	Vegetation surveys		
	Toxicity test results	Amphipod and Midge	NOAEL 82.87 mg/kg total PAHs, LOAEL 197.6 mg/kg total PAHs
	Evaluation of the benthic macroinvertebrate population/ community structure		In areas of high total PAH sediment concentration, reduction in population of benthic organisms present
3) Protection of the upland soil community functioning	Toxicity test results	Earthworm	NOAEL 587 mg/kg total PAHs and LOAEL 1264 mg/kg total PAHs
	Plant community surveys		Areas of stressed vegetation associated with elevated levels of contamination
4) Protection of the structure and function of the terrestrial plant community	Plant community surveys		Negative effects of contamination on upland plants particularly in areas where visible contamination found

Assessment Endpoint	Lines of Evidence	Ecological Receptor	Weight of Evidence
5) Protection of fish populations and communities from direct toxicity and reproductive impairment	Embryo toxicity tests	Killifish	NOAEL 33.5 mg/kg total PAHs
	Potential indirect effects based on benthic macroinvertebrate toxicity tests		
6) Protection of amphibian population, specifically in terms of recruitment	Toxicity test results	Southern Leopard Frog	Risk exists, effects levels consistent with other sediment contamination related risks

For both the sediment and soil toxicity tests, the distribution of contaminants at the Site presented a dilemma in obtaining samples for testing and the determination of NOAEL (No Observed Adverse Effects Level) and LOAEL (Lowest Observed Adverse Effects Level) values. The distribution of total PAH contamination can be characterized as having sharply defined highly contaminated areas and limited areas that have intermediate levels of contamination. The result of these circumstances is that the toxicity results do not generate a gradient of toxicity responses; the results were either that the soil or sediment sample caused death or had no measured effect. While this presented technical difficulties in the risk calculations, it clearly defines where severe ecological risks exist and where they do not exist. In addition, the physical areas of uncertainty (the area and volume of intermediately contaminated soil and sediment) is a relatively small zone around areas of high contamination levels. Therefore, the cleanup volumes are not very sensitive to changes in the cleanup goals.

The amphipod, *Hyallela azteca*, lives in close association with sediments, as does the larva of the midge, *Chironomus tentans*. These two organisms were used under standardized solid-phase sediment testing procedures to determine if the contaminated sediments at the Site caused mortality (the test organisms died when exposed to sediment from the Site) or non-lethal adverse effects (such as reduced growth). Where adverse effects were determined, the concentrations of contaminants in test sediments were used to evaluate at what concentrations minimal or no adverse effects may occur (the NOAEL), and above what contaminant levels adverse effects would be expected (the LOAEL). In addition, the type of the adverse effect (e.g., death or reduced growth) was taken into consideration in evaluating the certainty and the severity of risk.

The NOAEL was calculated to be 83 mg/kg and the LOAEL was calculated to be 198 mg/kg for total PAHs.[2]

Fish that utilize the Site can be impacted by contaminants in two ways: (1) short-term toxicity and (2) long-term reproductive effects on organisms exposed as larvae or juveniles. Short-term toxicity of Site contaminants to killifish (*Fundulus heteroclitus*) embryos was assessed in a 10-day solid-phase sediment toxicity test. The bioaccumulation potential of each contaminant was assessed through a review of the fish tissue data collected at the Site. Indirect effects on fish populations were inferred through the midge and amphipod toxicity tests, since benthic macroinvertebrates comprise a large percentage of predatory fish forage. No significant correlations between fish survival and level of measured contaminants were found. A NOAEL for total PAH concentration was calculated at 33.5 mg/kg based upon sublethal effects. However, as described on page 9 in the preceding section, recent studies conducted by the USFWS and the State found an approximately 40% incidence of liver tumors, among other health effects, in fish in Hershey Run.

To evaluate the potential effects of Site contaminants on the structure and function of the soil community, 7, 14, and 28-day solid-phase toxicity tests were conducted with the earthworm, *Eisenia foetida*. The toxicity tests provided information on the toxicity of soil contaminants to this species and potentially other soil invertebrate species found on-site. In addition, the bioaccumulation potential of Site contaminants was assessed by analyzing all surviving earthworms for contaminants of concern potentially present in their tissues.

Earthworm survival was reduced in PAH-contaminated samples from the upland area of the Site, with complete mortality occurring by day 7 of the 28 day test (none of the worms survived). Survival in all other soil samples was greater than 94 percent. Growth was significantly lower in the PAH-contaminated samples from the upland wood storage yard. From the toxicity data, PAHs were determined to be the compounds that were responsible for the observed toxicity. The NOAEL for total PAH concentration for the tests conducted was determined to be 587 mg/kg and the LOAEL was 1,264 mg/kg.

Vegetation surveys conducted during the Remedial Investigation showed negative effects of contaminants on upland plants, particularly in areas of visible contamination.

In summary, it is concluded that PAHs pose ecological risks to the upland, wetland and aquatic communities at the Site, specifically to organisms low in the food chain (i.e., earthworms, insects, shelled organisms, fish and frog embryos, and both upland and aquatic plants).[3] In

---

[2]Note that there appeared to be risk caused by zinc as well which is not a site-related contaminant.

[3]It is likely that zinc, which can be found at levels in the thousands of parts per million, poses an ecological risk at the Site as well. However, the zinc is not site-related, but EPA's preferred alternative would address the vast majority of the elevated zinc because the elevated zinc is generally co-located with elevated levels of PAHs (when the zinc is not co-located with

general the aquatic assessment endpoints were more sensitive than the terrestrial assessment endpoints with respect to the calculated NOAEL and LOAEL levels. For the aquatic assessment endpoints the NOAEL was calculated to be 82.87 mg/kg total PAHs and the LOAEL was calculated to be 197.6 mg/kg. For the pure terrestrial assessment endpoints the NOAEL was determined to be 587 mg/kg total PAHs, with a LOAEL of 1,264 mg/kg.

Based on the results of the risk assessment, EPA has determined that for this Site, a sediment cleanup criteria of 150 mg/kg total PAHs (approximately the geometric mean between the sediment NOAEL of 83 and the LOAEL of 198) and a soil cleanup criteria of 600 mg/kg total PAHs (just above the NOAEL of 587)[4] are the appropriate levels to provide protection to the environment.

By comparing maps of total PAH values to those of benzo(a)pyrene equivalences ("B(a)P equivalence"), it has been determined that these cleanup criteria will also be protective of human health for potential future industrial workers and trespassers.

PAHs, it exists at depth in sediments such that it does not pose a threat to ecological receptors). The zinc most likely came from the adjacent Superfund site, the DuPont-Newport site, where zinc was a major contaminant. The DuPont-Newport site completed construction in 2002. There are other zinc sources in the watershed, most notably the NVF Yorklyn site upstream on Red Clay Creek. EPA does not believe that the other sources would cause recontamination. Data evaluated during the DuPont-Newport remedy selection process showed that the zinc from the NVF site was not causing sediment contamination in the vicinity of the Koppers and DuPont sites. Since the time of the DuPont-Newport Record of Decision, work has been conducted to help control zinc discharges in the watershed which will only further prevent recontamination. In addition, the State has been developing a TMDL for zinc for both the Red Clay Creek and the Christina River which should help minimize the potential for recontamination in the future.

[4]EPA does not believe that using the geometric mean of the soil NOAEL and LOAEL to determine the soil cleanup criteria would be protective because the result would be much higher and could result in potential for contaminated soil to act as continuing source of contamination to the wetlands. EPA believes that the 600 mg/kg soil cleanup goal would provide adequate protection to the wetlands since it is a “not-to-exceed” value which would result in average surface soil concentrations of total PAHs of a much lower value. Once vegetation has been reestablished after the cleanup, the possibility for recontamination is very remote. One hypothetical area where it could happen is if an area of soil was just below the 600 mg/kg soil cleanup criteria and located adjacent to a wetland that was just below the 150 mg/kg sediment cleanup criteria such that erosion could increase the wetland concentration to above 150 mg/kg, thus creating an unacceptable risk. With the fact that the concentration gradients at the Site are steep (i.e., the contamination goes from high to low in a short distance), any areas that would match this condition would be small and would not warrant a change in the soil cleanup criteria.

Summary

It is EPA's determination, subject to public notice and comment, that the Preferred Alternative identified in the Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

Scope and Role

The actions proposed by EPA in this document constitute a comprehensive approach for addressing all of the environmental problems at the Site. The actions proposed at this time are expected to be the final actions that will be necessary to completely address the risks from the contamination at the Site. There have been no previous cleanup efforts at the Site by EPA or the State.

The proposed cleanup addresses areas where contamination is just above the cleanup criteria to areas where contamination is so high and prevalent that it is visible and flows freely as a separate phase. One concept that often plays an important role when EPA determines how to address contamination at a Superfund site is the concept of "**principal threats**." EPA characterizes waste on-site as either principal threat waste or low-level threat waste. The concept of principal threat waste and low-level threat waste, as developed by EPA in the NCP, is applied on a site-specific basis when characterizing source material. "Source material" is defined as material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to ground water, to surface water, to air, or that act as a source for direct exposure. Source materials are considered to be principal threat wastes when they contain high concentrations of toxic compounds (e.g., several orders of magnitude above levels that allow for unrestricted use and unlimited exposure) or are highly mobile and generally cannot be reliably contained.

From the results of the RI/FS for the Koppers Site, EPA considers the NAPL in the shallow and subsurface soils and sediments to be principal threat waste because it is source material that contains hazardous substances, pollutants, or contaminants that act as a reservoir for the migration of contamination to surface water and/or ground water.

Section 300.430(a)(1)(iii) of the NCP states that "EPA expects to use treatment to address the principal threats posed by a site, wherever practicable," that "EPA expects to use engineering controls, such as containment, for waste that poses a relatively low, long-term threat or where treatment is impracticable," and that "EPA expects to use a combination of methods, as appropriate, to achieve protection of human health and the environment." It also states that "EPA expects to use institutional controls...to supplement engineering controls as appropriate...," and that institutional controls may be used "where necessary, as a component of the completed remedy." However, the NCP also states that institutional controls "shall not substitute for active response measures...as the sole remedy unless such active measures are determined not to be practicable..." After giving careful consideration to the expectations in the NCP regarding principal threat waste and to the nine criteria in the NCP which EPA is required to use to evaluate various possible remedial alternatives, EPA is proposing an alternative that uses containment rather than treatment to address principal threat waste. The range of alternatives includes a treatment alternative. EPA's rationale for proposing a containment remedy is discussed in detail in later sections of this Proposed Plan.

In regard to ground water, the NCP describes EPA's expectation to return contaminated ground water to its beneficial use, which in this case would be to a condition that would allow human consumption. While EPA's experience is that is difficult to clean up ground water that contains NAPL to such a degree as to allow drinking, EPA believes that at this Site, by isolating the worst NAPL in the containment areas, ground water outside the containment areas can be returned to its beneficial use.

Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site are as follows:

1. Prevent current or future direct contact with contaminated soils and sediments that would result in unacceptable levels of risk to ecological receptors by reducing levels of total PAHs concentrations to below 150 mg/kg in sediment and 600 mg/kg in soil (150 mg/kg in soil that is to be converted to wetlands);

2. Prevent unacceptable human health risks due to exposure to contaminated ground water;

3. Minimize the on-going contamination of ground water from the presence of NAPL through removal and/or containment;

4. Prevent any direct contact threat to an adult or child trespasser and to an industrial worker;

5. Prevent the construction of residential buildings (which are currently prohibited by local zoning) in order to protect potential future residents from contact with contaminated soil and/or ground water;

6. Restore ground water at the Site to its beneficial use.

Summary of Alternatives

During the **Feasibility Study**, various alternatives to cleanup the contamination at the Site were developed. EPA evaluated a number of alternatives, including the range of alternatives described in detail below, in order to determine which cleanup method would be best. EPA's preferred alternative is Alternative 4 (see page 23). Further information may be obtained from the Administrative Record.

The alternatives describe possible actions to address contamination in the following areas: 1) upland soils, 2) Hershey Run, 3) the Fire Pond, 4) the South Pond area (the non-tidal South

Pond itself and the tidal West Central Drainage area), 5) the K Pond area and 6) ground water. (See Figure 2.)

Common Elements

Each alternative, except the “no action” alternative, contain some common elements that were considered in the evaluation process. The common elements include:

1. Ground Water: Each alternative includes monitoring of dissolved phase contamination in both the Columbia and Potomac aquifers until such a time as contaminant levels fall below levels EPA determines are safe to drink (approximately 20 wells - 10 in the Columbia and 10 in the Potomac aquifer). Although no creosote contamination was found in the Potomac aquifer during the RI, monitoring is necessary to ensure that contamination does not spread into the Potomac since mobile dense NAPL (or DNAPL) was found in the Columbia aquifer. Several new Potomac aquifer wells would be installed closer to the processing areas to aid in this monitoring. DNREC would create a ground water management zone (GMZ) that would include the Site and enough adjacent areas such that pumping wells could not draw contamination from the Site, either laterally or downward into the Potomac. (There currently exists a GMZ encompassing much of the adjacent DuPont-Newport Superfund Site.) The GMZ would have to remain in effect in perpetuity for Alternatives 2 and 3 because they do not fully address ground water contamination and for Alternative 4 because of the waste remaining in the containment areas (although this could be smaller in size once EPA has determined that ground water outside the containment areas is safe to drink). Under Alternative 5, this GMZ could be lifted once MNA has succeeded in reducing contaminant concentrations to acceptable levels (presumably in 30 years, though possibly more). For those alternatives which include NAPL recovery, a characterization of any recovered NAPL would be conducted in order to determine an optimal method for disposal. For the purposes of estimating costs, it was assumed that all recovered NAPL would be drummed, characterized and incinerated off-site at an appropriate permitted facility (in accordance with CERCLA 121(d)(3)), although it is possible that the creosote NAPL may be suitable for recycling. In addition to these measures, each alternative would include an evaluation to be conducted to verify the extent of NAPL at the Site, including along the ballast of the Amtrak railroad line along the northern boundary of the Site.

2. Land-use restrictions: Land-use restrictions or institutional controls would be used 1) to ensure that the land was not used for residential purposes or other purposes that would cause a risk to human health due to any contamination that would remain on-site after the cleanup was complete, and 2) to ensure that any activities that may take place on the Site after cleanup do not interfere with any components of the remedy and are conducted in a manner to protect the health of future construction workers. For example, if any structures were to be constructed in the future on top of the containment area, they may be restricted to minimal intrusion into the subsurface in order to protect the cap (e.g., foundations may be restricted to a minimum number of pilings with slab construction above, thereby potentially limiting the size of a structure). These institutional controls could include such things as deed notices, and/or requirements that workers who might come into contact with any remaining contamination on-site be properly protected in accordance with the current Site Health and Safety Plan and/or Operations and Maintenance Manual. The institutional controls may include restrictions which will operate as a

covenant running with the land burdening the property such as: a) activity restrictions (limitations on activities and use which may be conducted on the property, i.e. only those activities which do not interfere with the ongoing protectiveness and effectiveness of the Remedial Action); b) restrictions on the disturbance of the soil (limitations on activities that could cause interference with or disturbance of the Remedial Action, disturbance of surface soils or protective Site features, or a risk of soil erosion or exposure to remaining contamination, especially in the containment area); and c) ground water restrictions (limitations on activities which would use ground water or cause a change in hydraulic conditions that could interfere with the ongoing protectiveness and effectiveness of the Remedial Action).

Note that the Total Present Worth Cost for each alternative was calculated using a 7% discount rate and an Operations and Maintenance ("O&M") period of 30 years (unless mentioned otherwise).

Alternative 1 *No Action*

Capital Cost:	$ 0
Annual O&M Costs:	$ 0
Total O&M Costs:	$ 0
Total Present Worth Cost:	$ 0

Under this alternative, no remedial measures would be implemented at the Site to prevent exposure to the sediments, soil, NAPL and ground water contamination. The "no action" alternative is included because the National Contingency Plan (NCP) requires that a "no action" alternative be developed as a baseline for evaluating other remedial alternatives.

Alternative 2 *Covering upland soils; Sediment cap in Fire Pond, South Pond and K Pond; Sheetpile and NAPL collection at Fire Pond and South Pond; Monitored Natural Recovery (MNR) in Hershey Run and tidal wetlands; Monitored Natural Attenuation of ground water contamination*

Capital Cost:	$ 15,934,988
Annual O&M Costs:	$ 125,500 *(for years 1-5)*
	$ 117,500 *(for years 6-30)*
Total O&M Costs:	$ 1,490,864
Total Present Worth Cost:	$ 17,425,852

In addition to the common elements described above, Alternative 2 includes the remedial measures detailed below, according to media. See Figure 7 for the further details.

Soils

In order to protect trespassers and ecological receptors from contaminated soils, this alternative includes the installation of a soil cover on top of the existing grade. This cover would consist of a geotextile layer followed by a 2-foot (ft) soil cover, including a burrow-inhibiting layer of stone, installed over upland surficial soils (0-24 inch layer) containing visual NAPL or total PAH concentrations greater than 600 mg/kg. Approximately 125,000 cy of cover materials would be brought in and placed over a total of 39 acres.

Sediments

In order to protect trespassers and ecological receptors from contaminated sediments, this alternative includes the installation of a 2-ft reactive (sorbent) cap over sediments in the Fire Pond, South Ponds, and K Area (totaling approximately 0.7 acres). This cap will be constructed (from bottom to top) of geotextile, approximately 1 ft of sorbent material (e.g., a mixture of clay, anthracite, and soil that significantly retards potential movement of contaminants through the cap), and 1 ft of sand. This alternative also includes monitored natural recovery of sediments in Hershey Run, Hershey Run Marsh, and the West Central Marsh Drainage.

Ground Water

To prevent future releases of NAPL to surface water and sediments that could cause risks to trespassers and ecological receptors, Alternative 2 includes the installation of approximately 1,000 and 1,100 ft of sealed steel sheetpile walls at the South Ponds and Fire Pond, respectively. This sheetpile would be keyed into the low permeability, fine-grained layer underlying the Site at depths ranging from approximately 15 to 30 ft bgs. Shallow hydraulic gates would be incorporated into the top of the walls of the sheetpiling to allow ground water to flow through the upper portions of the aquifer (thus preventing the build up of hydraulic head behind the wall) while NAPL is retained below. In addition, this alternative includes monitoring and passively removing NAPL from interceptor trenches installed behind these sheetpile walls, with the collected NAPL to be disposed of or incinerated off-site in accordance with CERCLA 121(d)(3). NAPL would remain in the ground water outside the containment area, preventing the restoration of ground water to its beneficial use.

Alternative 3 *Excavate, consolidate and cap shallow soils and shallow tidal sediments; Cap Fire, K and South Ponds; Sheetpile and NAPL collection at Fire Pond and South Ponds areas; Rechannelization of Hershey Run; Wetlands mitigation; Monitored Natural Attenuation of ground water contamination*

Capital Cost:	$ 40,094,305
Annual O&M Costs:	$ 261,937 *(for years 1-5)*
	$ 261,937 *(for years 6-30)*
Total O&M Costs:	$ 3,250,383
Total Present Worth Cost:	$ 43,344,688

In addition to the common elements described above, Alternative 3 includes the remedial measures detailed below, according to media. See Figures 8 and 9 for the further details.

Soils

In order to protect trespassers and ecological receptors from contaminated soils, this alternative includes the excavation of upland surficial soils containing visual NAPL or total PAH concentrations greater than 600 mg/kg to a depth of 2 ft bgs, followed by consolidation in an on-site containment area (approximately 115,000 cy of surficial soils would be removed over an approximately 35-acre area into a 4-acre containment area in either the former Process area or Drip Track area) which would then be capped with a geomembrane (see Figure 8). The excavated areas would be filled with clean soil to restore the grade. In areas that the soil at 2 ft bgs still remained above the soil cleanup criteria of 600 ppm total PAHs, a geotextile layer would be placed to separate the contaminated soil from the clean soil.

Sediments

In order to protect trespassers and ecological receptors from contaminated sediments, this alternative includes the installation of a cap over sediments in the Fire Pond, South Pond, and K Area as described in Alternative 2.

In addition, Alternative 3 would include the relocation of the channel of the upper portion of Hershey Run, as depicted in Figure 9, so that the new channel would bypass the NAPL-impacted area to the west of the Fire Pond which would be contained using sheetpile (described below). To create the new channel (approximately 800 ft long and 0.8 acre in size), this alternative would require the removal of approximately 6,500 cy of marsh sediment which would be deposited behind the sheetpile to fill the currently existing channel. The new channel would be constructed in such a way as to maximize habitat and control erosion. Additional clean fill would be required within the sheetpile area to bring the grade to the top of the sheetpile (set at approximately 6-ft elevation or high high tide). EPA expects that this area would remain a wetland, although non-tidal.

While the added containment area would enclose the majority of the NAPL underneath Hershey Run and adjacent wetlands, it would not contain all of the NAPL. Therefore, to prevent any NAPL migration to the surface in this area where it could present a risk to trespassers and ecological receptors, the portions of existing Hershey Run that would be outside the containment area yet, due to the geometry, not be part of the new channel, would be capped with 1 ft of reactive cap material and 1 ft of sediments.

In the remainder of the Hershey Run channel (the lower portion) and marsh and the West Central Drainage Areas, surficial sediments (within the upper 1 ft bgs) containing total PAHs greater than 150 mg/kg would be excavated, thus providing protection for trespassers and ecological receptors. This excavation of surficial sediments is expected to generate 23,000 cy over an area of 9 acres.

Where contamination exists below 1 ft bgs, an additional 1 ft of sediment would be excavated and a cap installed. Installation of a cap would inhibit the migration or erosion of PAH-contaminated materials which could recontaminate the wetlands or migrate off-site. The cap constructed in the channel portion of the drainage areas would consist of 0.5 ft of reactive material, on top of which would be placed 1.5 ft of sand, geotextile, and 0.5 ft of armor stone**,** respectively. The marsh area cap would be of similar construction, however, 0.5 ft of soil would be placed on top of the sand, instead of the geotextile and armor stone, as erosional forces are expected to be less outside the channel in the marsh areas. The additional excavation needed to accommodate the cap is expected to generate 25,000 cy over an area of 6.2 acres. Sediment monitoring would be conducted in wetlands with caps to verify that the contaminated materials remain isolated. Monitoring would also take place where any wetlands were disturbed to ensure that restoration activities were successful.

If any wetland acreage is lost within the containment area, this alternative would, to comply with EPA's Wetlands Policy, include creating replacement wetlands commensurate with the acreage of wetlands filled at the Site (at a minimum ratio of 1:1).

Overall, approximately 55,000 cy of sediments (including about 15% added volume due to stabilization to improve soil properties to support a cap) would be added to the landfill area created with consolidated upland surface soils.

Ground Water

To prevent future releases of NAPL to surface water and sediments where it could cause risks to trespassers and ecological receptors, this alternative includes sheetpile wall installations at the Fire and South Ponds as described in Alternative 2. However, due to the rechannelization of Hershey Run, in Alternative 3 an additional 600 ft of sealed steel sheetpile would be installed in the Fire Pond area to contain subsurface NAPL extending from the Fire Pond underneath wetlands across Hershey Run from the pond (See Figure 9). The sheetpile in the marsh would be set at or above the high high-tide elevation to preclude consistent surface water inundation. NAPL would remain in the ground water outside the containment area, preventing the restoration of ground water to its beneficial use.

Alternative 4 *Excavate, consolidate and cap all contaminated soils and sediments; Subsurface ground water barrier wall around consolidation area(s) with passive NAPL recovery; Restoration of ground water through excavation of NAPL-contaminated aquifer material outside of consolidation areas; Rechannelization of Hershey Run; Wetlands mitigation; Monitoring of ground water contamination*

Capital Cost:	$ 49,837,587
Annual O&M Costs:	$ 227,267 *(for years 1-5)*
	$ 118,767 *(for years 6-30)*
Total O&M Costs:	$ 1,918,652
Total Present Worth Cost:	$ 51,756,239

In addition to the common elements described above, Alternative 4 includes the remedial measures detailed below, according to media. See Figure 10 for the further details.

Soils

In order to protect trespassers and ecological receptors from contaminated soils, soil would be excavated as in Alternative 3 (soil with visible NAPL or total PAHs above 600 mg/kg). In addition, excavation would continue in these areas until the total PAH concentration was 150 mg/kg or below, with excavation depths potentially reaching as deep as 30 ft bgs in a few locations, though the average excavation depth is expected to be 5 to 15 ft. Instead of backfilling these areas, the areas would be graded appropriately and wetlands would be created, minimizing the increase in cost over a shallower excavation since no outside fill would be needed. An estimated 113,000 cy of soil would be excavated and consolidated into two on-site landfills. The location of the landfills would coincide with the areas of upland that have the greatest amount of NAPL in soil and the ground water, thus reducing the amount of excavation required and allowing the landfills and the NAPL recovery areas (described below) to be located together. The two landfills would cover approximately 38 acres and would be used to contain all contaminated material excavated as part of this alternative. This alternative would allow for the cover material (over the geomembrane) to come from areas of the Site with clean soil. This fits with one possible reuse of the Site - wetland creation - since extra excavation would be required to create the wetlands. The cost estimate for this alternative assumes that the cover material is coming from the Site.

Sediments

In order to protect trespassers and ecological receptors from contaminated sediments, this alternative would involve the complete excavation (and consolidation into on-site landfills) of contaminated sediments (containing total PAHs above 150 mg/kg) in the Fire Pond, South Pond, K Area, West Central Drainage Area, lower Hershey Run and the marsh adjacent to the upper portion of Hershey Run. The depth of excavation ranges from 0 to 13 ft with an average of 2-4 ft. Restoration activities would take place as appropriate to provide suitable ecological habitat. Backfilling shall be required to restore the original stream profile, unless it can be otherwise shown, as determined by EPA, that an alternate design may be hydrodynamically stable and ecologically advantageous. If that is the case, there would likely be a cost savings associated with the reduction in need for backfill. The use of minor backfilling may be able to effectively increase the diversity of the wetland types at the Site.

As in Alternative 3, this alternative would involve the rechannelization of upper Hershey Run to allow the installation of sheetpile and passive NAPL recovery (see below). Any wetland acreage that was lost would be replaced at the Site. It is estimated that a total of approximately 75,000 cy of stabilized sediments would be added to the consolidation area (including a 15% increase in volume for stabilization to improve soil/sediment properties to support a cap).

Ground Water

In order to achieve the restoration of ground water, NAPL-contaminated aquifer material located outside of the containment areas would be excavated to depth (generally 5 to 15 ft deep, and occasionally to 30 ft) and isolated in the on-site landfills (as described above). To prevent future releases of NAPL to surface water and sediments that could cause risks to trespassers and ecological receptors, as well as to control the source of ground water contamination, this alternative includes the sheetpile and passive NAPL collection in the area of the Fire Pond as in Alternative 3, with the extensive addition of sheetpile or other low permeability ground water barrier[5] (and associated passive NAPL recovery) around the two landfills. The landfills would be located over the areas of most extensive NAPL contamination where NAPL, based on observations during the RI, may still be mobile. This alternative also includes the excavation of NAPL material from below the wetlands in the South Pond and adjacent West Central Drainage area, as well as from the K area. By aggressively addressing these NAPL areas (i.e., the sources of contamination), natural attenuation would restore the ground water outside of the containment area to its beneficial reuse and no sediment caps would be required to prevent the recontamination of the wetlands. The passive NAPL recovery trenches would also be used to manage the level of ground water inside of the barrier walls, draining ground water for surface discharge (following treatment via oil-water separation and carbon filtration, if necessary). Monitoring of ground water and sediments would be conducted to verify the effectiveness of containment and the continued attenuation of any dissolved phase contamination.

Studies, including ground water modeling as appropriate, would be conducted during the Remedial Design to determine the optimal configuration for the passive NAPL recovery trenches and system, and would specifically seek to minimize the complexity of the system and, to the extent possible, minimize the need for ground water treatment prior to discharge. Given the mobility of NAPL at the Site, as demonstrated by the extent to which NAPL has already migrated beneath and into the Hershey Run marsh, EPA believes that passive NAPL recovery would successfully and significantly reduce the volume of mobile NAPL at the Site. At the same time, this NAPL recovery system would provide the opportunity for managing ground water (as described above). If monitoring shows that it is necessary to ensure compliance with the substantive requirements of the NPDES program and State Water Quality Standards, ground water drained through the recovery trenches would be treated using an oil-water separator and/or carbon filtration system in order to remove any contamination before it is discharged to surface water.

Alternative 5 *In-situ steam-enhanced extraction of subsurface NAPL; excavation and off-site treatment of sediments and certain soils; Wetland restoration; Monitored Natural Attenuation of ground water contamination*

Capital Cost:	$ 189,365,815
Annual O&M Costs:	$ 169,000 *(for years 1-5)*
	$ 87,500 *(for years 6-30)*
Total O&M Costs:	$ 1,419,957
Total Present Worth Cost:	$ 190,785,772

In addition to the common elements described above, Alternative 5 includes the remedial measures detailed below, according to media. See Figure 11 for the further details.

Soils

Upland soils containing visual, weathered NAPL would be excavated and transported off-site for

[5]The cost estimate assumed 1,375 ft (25%) of sheetpile and 4,125 ft (75%) of slurry wall.

treatment via low temperature thermal desorption (LTTD) and then landfilled in accordance with Section 121(d)(3) of CERCLA and 40 C.F.R. §300.440. In addition, upland soils with total PAH concentrations greater than 600 mg/kg that are outside of the area undergoing *in-situ* steam-enhanced extraction (see description below for ground water) would be excavated to a depth of 2 ft bgs and treated off-site. The excavated areas would be backfilled with clean fill and revegetated. Approximately 106,000 cy of surficial soils would be removed and backfilled over a 33-acre area. A staging area would be constructed in the former Process or Drip Track areas.

Sediments

The sediments in the Fire Pond, South Ponds, and K Area would be addressed as part of the *in-situ* steam-enhanced extraction at the subsurface NAPL areas (see below).

As described in Alternative 3, the upper portion of Hershey Run would be rechannelized so that the new channel would bypass the NAPL-impacted area adjacent to the Fire Pond (which would be addressed through *in-situ* steam-enhanced extraction, as described below under for ground water). Although the NAPL would eventually be addressed by the *in-situ* steam-enhanced extraction, the rechannelization and sheetpile would be necessary to prevent Hershey Run from becoming an infinite heat sink, substantially increasing fuel costs and likely preventing the appropriate temperature increase.

All surface and subsurface sediments containing total PAHs greater than 150 mg/kg would be excavated from the lower portion of Hershey Run, Hershey Run Marsh to the west of the proposed sheeting, and the West Central Drainage Area waterway and marsh, with removal depths up to 13 ft. The excavated sediments would be treated and disposed of along with the soils, as described above.

Ground Water

To prevent future releases of NAPL to surface water and sediments where it could cause risks to trespassers and ecological receptors, as well as to restore ground water to its beneficial use through source control and natural attenuation, NAPL contamination would be addressed through thermally-enhanced *in-situ* extraction. The particular thermal enhancement proposed is known as “steam injection” or dynamic underground stripping. This technique would be used to remove subsurface NAPL at all upland areas and subsurface NAPL beneath the Fire Pond and South Ponds areas.

In-situ steam-enhanced extraction would require steam to be generated at the surface and injected into arrays of injection wells in an effort to heat the subsurface NAPL zones and recover NAPL through multi-phase extraction wells. During steam injection, some of the NAPL constituents would distill or volatilize, become more mobile, and could then be removed via extraction wells. Due to the high heat and oxygen introduced in the steam, some NAPL would be destroyed through physical and chemical degradation. The injection and extraction wells would be spaced according to the depth of the impacted zones, which may range from approximately 5 to 15 ft bgs, and in some cases up to 30 ft bgs. Because of the shallow depth of the target zone, the soil surface would have to be covered, potentially with asphalt, to prevent steam from venting at the surface. Steam, liquid, and noncondensible gases would be removed from the ground and captured in a recovery system, where fluid separation and treatment technologies would be required. Recovered NAPL would be retained in storage tanks prior to transport and off-site incineration. Three-phase resistive heating may be used as a complement to *in-situ* steam injection in an effort to heat low-permeability soil zones within the target areas. As part of the pre-design investigation, an extensive pilot study would first be required to develop process control parameters.

Infrastructure would be constructed at the Site including an electrical supply grid, steam boilers, boiler fuel supply such as propane or natural gas, injection and extraction wells, steam conveyance piping, recovered fluids conveyance piping, and a network of roads to access all of the treatment areas. The fluid separation system would separate vapors, liquids, and NAPL. A vapor treatment system would be designed and constructed to treat recovered vapors prior to discharge to the atmosphere. A water treatment system would be designed and constructed to treat recovered liquid prior to discharge.

Once the steam injection and extraction is completed (over a period of several years), monitored natural attenuation would allow for the eventual restoration of ground water at the Site to a beneficial use (potentially in 30 years).

Evaluation of Alternatives

In this section, EPA evaluated the alternatives in detail to determine which alternative EPA believes would be the most effective in achieving the goals of CERCLA, and in particular, achieving the Remedial Action Objectives for the Site. EPA uses nine criteria to evaluate each of the cleanup alternatives individually and in comparison to each other in order to select a remedy. Below is a description of each of the nine criteria set forth in the NCP, 40 C.F.R. § 300.430(e)(9). These nine criteria can be categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria.

The Nine Criteria

Threshold Criteria:

1. *Overall Protection of Human Health and the Environment* addresses whether a remedy provides adequate protection to human health and the environment and describes how risks are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. *Compliance with Applicable or Relevant and Appropriate Requirements* (ARARs) addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of environmental statutes, regulations, and/or whether there are grounds for invoking a waiver.

Primary Balancing Criteria:

3. *Long-term Effectiveness* refers to the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals are achieved.

4. *Reduction of Toxicity, Mobility, or Volume through Treatment* addresses the degree to which alternatives will reduce the toxicity, mobility, or volume of the contaminants causing Site risks through treatment.

5. *Short-term Effectiveness* addresses the period of time needed to achieve protection and any adverse impacts on human health and environment that may be posed during the construction and implementation period until cleanup goals are achieved.

6. *Implementability* addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. *Cost* includes estimated capital and operation and maintenance costs, usually combined as the present worth cost.

Modifying Criteria:

8. *State Acceptance* indicates whether, based on its review of backup documents and the Proposed Plan, the State concurs with, opposes, or has no comment on the preferred alternative.

9. *Community Acceptance* will be assessed in the Record of Decision following a review of public comments received on the Proposed Plan and supporting documents included in the Administrative Record.

Overall Protection of Human Health and the Environment

A primary requirement of CERCLA is that the selected remedial action be protective of human health and the environment. An alternative is protective if it reduces current and potential future risks associated with each exposure pathway at a Site to acceptable levels.

The “no action” alternative (Alternative 1) does not meet this threshold criterion for several reasons. Without any active remediation at the Site, a number of risks (both current and potential) would remain, including: 1) risks would remain for potential future industrial or construction workers from exposure to both soil and ground water; 2) current risks would remain to ecological receptors in aquatic areas such as the Fire and South Ponds, the K Area, Hershey Run and associated wetlands and in upland soil areas; 3) potential future risks to ecological receptors could increase if the Site were developed to increase wetland acreage; and 4) while not readily quantifiable, risks to trespassers would remain from exposure to NAPL that can be released while wading in sediments in Hershey Run. Since the “no action” alternative does not meet this threshold criterion, it will not be considered any further.

Each of the other alternatives (Alternatives 2, 3, 4, and 5) would offer protection of human health from soil contamination through the use of institutional controls to prevent future use of the Site for residential purposes and to ensure that any industrial use was conducted in such a way as to ensure the protection of workers.

For human health risks due to ground water, each alternative would initially address risks through the creation of a ground water management zone (GMZ) by the State of Delaware that would prevent any drinking water wells from being installed. Each alternative would include monitoring until the ground water is restored to its beneficial use (which for Alternatives 2 and 3 could practically be forever). Alternatives 2, 3 and 4 would control NAPL to varying degrees with the use of ground water barrier walls, creating areas that would not be cleaned up and would rely solely on the GMZ. Additionally, Alternative 4 would excavate NAPL found outside of the consolidation areas and provide for complete containment of NAPL through far more extensive barrier walls. Alternative 4 is further augmented by extensive efforts to passively recover NAPL within the containment areas. Alternative 5 would aggressively address NAPL with *in-situ* steam-enhanced extraction followed by monitored natural attenuation to finish the cleanup. Only Alternatives 4 and 5 provide overall protection to human health from ground water risks and restoration of ground water to its beneficial use (one of the RAOs), thus restoring the ground water to its beneficial use.

In regard to protection of the environment, each of the alternatives would protect upland species. Alternatives 2 and 3 would provide a clean "living layer" of soil by either covering soil contamination (soil with total PAH concentrations above 600 mg/kg) with clean soil (Alternative 2) or by removing and replacing the top layer of soil (Alternative 3). Alternative 4 would address risks from upland soil by removing all soil that is above the Site-specific soil cleanup criteria of 600 mg/kg with replacement (whole or partial) possibly occurring depending on the type of habitat desired. Alternative 5 addresses these risks by removing contamination through a combination of excavation (when weathered NAPL is visible) and removal and/or destruction of contaminants through *in-situ* steam-enhanced extraction.

Alternative 2 would involve sediment caps in the Fire Pond, South Pond, and K Area to prevent receptors from coming into contact with contamination. Sheetpile would be installed at the Fire Pond and the South Pond, along with passive NAPL collection, to prevent NAPL migration to water bodies. However, Alternative 2 would not be protective in Hershey Run because, like the "no action" alternative, it would not address NAPL and PAHs in the sediments of lower Hershey Run except through natural recovery. EPA does not believe that natural recovery could reduce the risks posed by the sediments in lower Hershey Run because of the amount of contamination present. In addition, this material was used in the wood treating industry to prevent biodegradation of wood. Any biodegradation that would take place, would do so at a slow rate.

Alternative 3 would also involve sediment caps in the Fire Pond, South Pond, and K Area to prevent receptors from coming into contact with contamination. In addition, aquatic risk in Hershey Run and the adjacent marsh and the West Central Drainage area would be addressed by excavating the top 2 ft with a reactive cap placed in areas where elevated levels of contamination remained below. Sheetpile would also be installed at the Fire Pond (although over a greater area to enclose more NAPL, but resulting in the need to rechannelize Hershey Run) and the South

Pond, along with passive NAPL collection, in order to prevent NAPL migration to water bodies and to mitigate an on-going source of contamination to the water bodies.

Alternative 4 would address risks to aquatic receptors by aggressively excavating all sediment above the site-specific cleanup criteria of 150 mg/kg total PAHs in the South Pond, K Area, Hershey Run and adjacent marsh and the West Central drainage area. Risks in the Fire Pond would be addressed by filling the Fire Pond as part of the consolidation of contaminated soils and sediments.

Alternative 5 would address risks to aquatic receptors by removing and/or destroying subsurface contamination using *in-situ* steam-enhanced extraction, and by removing all contaminated sediments for treatment off-site.

In terms of comparison, EPA believes Alternatives 4 and 5 provide the highest degree of overall protection of human health and the environment since they address all of the risks, provide the most aggressive cleanup and rely the least on institutional controls. Alternative 3 provides a greater degree of protection compared to Alternative 2 since it provides for a greater degree of capture of NAPL at the Fire Pond/Hershey Run area and addresses contaminated sediments in lower Hershey Run and the West Central Drainage area.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Any cleanup alternative considered by EPA must comply with all applicable or relevant and appropriate federal and state environmental requirements. *Applicable* requirements are those substantive environmental standards, requirements, criteria, or limitations promulgated under federal or state law that are legally applicable to the Remedial Action to be implemented at the Site. *Relevant and appropriate* requirements, while not being legally applicable, address problems or situations sufficiently similar to those encountered at the Site that their use is well-suited to the particular site. In a Record of Decision, EPA may waive an ARAR under certain conditions. EPA is not waiving any ARARs in the remediation of this Site.

Alternatives 2, 3, 4 and 5 each meet this threshold criterion. Some of the major ARARs for the Site include:

1. State and Federal water and air discharge requirements – Air emissions for any excavation or on-site treatment; water discharge or re-injection for de-watering during construction activities and for ground water collected in the recovery of NAPL.

2. State Water Quality Standards – State water quality standards will be attained during any Remedial Action taken. Any surface water discharge will meet the substantive requirements of the NPDES program and will be monitored to ensure compliance with these standards.

3. National Historic Preservation Act - Due to the long industrial and prior history of this Site, additional cultural resources surveys must be conducted prior to the beginning of

any Remedial Action. If cultural resources are found that are on, or eligible for, the National Register of Historic Places and would be impacted by the cleanup, including being covered by a cap or disturbed by excavation, mitigation activities may be required.

4. RCRA Hazardous Waste Disposal regulations - Since creosote is a listed waste, off-site disposal costs would be high. All creosote ultimately left on-site would be consolidated within an “area of contamination” without triggering RCRA’s “land-ban” regulations.

5. Ground water regulations **(Maximum Contaminant Levels or MCLs and non-zero Maximum Contaminant Level Goals or MCLGs)** - The ground water at the Site is a Class IIB aquifer, meaning that it is a potential source of drinking water. As such, MCLs and MCLGs are relevant and appropriate requirements. Only Alternatives 4 and 5 would meet these ARARs because only these alternatives aggressively address the NAPL (the source of the ground water contamination) outside of any area of consolidation or waste management area. Note that Section 300.430(f)(5)(iii)(A) of the NCP states that performance (for example, attainment of ARARs) shall be measured at appropriate locations in the ground water, surface water, etc. The preamble to the NCP explains that for ground water, remediation levels should generally be attained throughout the contaminated plume or at and beyond the edge of a waste management area when waste is left in place (55 FR 8753). Alternatives 2 and 3 would require an ARAR waiver in order to be selected as the cleanup for the Site.

Long-Term Effectiveness and Permanence

This evaluation criterion considers the ability of an alternative to maintain protection of human health and the environment over time. The evaluation takes into account the residual risk remaining from untreated waste at the conclusion of remedial activities as well as the adequacy and reliability of containment systems and institutional controls.

Since any containment system requires on-going Operations and Maintenance (O&M), Alternative 5, which includes *in-situ* treatment and excavation and off-site disposal, offers the highest degree of long-term protection because it would permanently remove contamination from the Site. The other alternatives that include containment on-site do provide long-term effectiveness, although to significantly varying degrees.

Of the on-site containment alternatives, Alternative 4 offers the highest degree of long-term effectiveness and permanence because all of the contamination is consolidated into two areas. Alternatives 2 and 3 leave more contamination in the wetland areas (Alternative 2 does not address NAPL contamination in lower Hershey Run) and rely on sediment caps to prevent recontamination (note that generally only an additional 2 ft of excavation would be required to remove all of the contamination and eliminate the need for the sediment caps). The inclusion in Alternative 4 of NAPL recovery from within the containment area would provide an additional degree of long-term effectiveness and permanence by removing NAPL that otherwise that may have the potential to flow downward into the Potomac. Alternatives 2 and 3 would be more susceptible to waste being exposed during severe storm or other erosional event as compared to Alternative 4.

Reduction in Toxicity, Mobility, or Volume Through Treatment

This evaluation criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility or volume of the hazardous substances as their principal element.

Alternative 5, by including *in-situ* extraction of subsurface NAPL, would provide the highest degree of reduction in the toxicity, mobility or volume of contaminants. The steam injection would destroy some contamination and would remove a majority from the environment, to be disposed of off-site.

The other alternatives would include sheetpiling and passive recovery (with off-site treatment and disposal) of NAPL (with Alternative 4 offering the most extensive recovery) that would provide for a reduction of the volume and mobility of NAPL.

Short-Term Effectiveness

This evaluation criterion addresses the effects of the alternative during the construction and implementation phase until remedial action objectives are met. It considers risk to the community and on-site workers and available mitigation measures, as well as the time frame for the attainment of the response objectives.

The construction of a soil cover or engineered cap in Alternatives 2, 3 and 4 would involve the delivery of a significant amount of clean soil, creating risks due to traffic through the small town of Newport and the Ciba Specialty Chemicals facility. This would be minimized by avoiding or minimizing the need for imported fill (i.e., through the use of clean soil from the Site for Alternative 4), and through the use of flag men and a zero-tolerance policy on speeding by the truck drivers.

The use of erosion and surface water control measures in each of the alternatives would minimize the potential for any release of contaminated sediment or soil to Hershey Run and White Clay Creek during construction. There is a chance for an air release of dust and contamination during excavation and when stock-piled material is stabilized or graded (a common element to several alternatives), but this can be monitored and controlled. Dust will have to be controlled during construction for any of the alternatives.

Alternative 5 offers the lowest degree of short-term effectiveness since it would take the longest to complete and would involve potential impacts due to the transportation of contaminated soil for off-site treatment and disposal. In addition, Alternative 5 includes the risk that high-temperature steam or contamination could escape to the air during the *in-situ* treatment.

From one aspect, Alternative 2 offers the highest degree of short-term effectiveness since it could be implemented in the shortest time period and it would disturb the least acreage of the Site, minimizing the potential for a release of contamination during construction. However, Alternative 2 would not involve any steps to reduce risk in lower Hershey Run. Alternatives 3 and 4 provide nearly the same degree of short-term effectiveness, with Alternative 4 providing slightly less because it involves the disturbance of more contaminated material.

Implementability

This evaluation criterion considers the technical and administrative feasibility of implementing an alternative and the availability of services and materials required during implementation.

Each of the alternatives is implementable and the services and materials required for each alternative are readily available. However, some are more difficult than others.

Alternatives 2 and 5 would be significantly more difficult to implement since they would require far more truck trips to bring in or remove material. This truck traffic would have to pass through an operating chemical plant, then through a small town. The added traffic burden to both the plant and the town is likely to meet some resistance, in addition to posing safety hazards for both.

Alternatives 2, 3 and 4 use simple construction techniques that are well understood. Alternatives 3 and 4 would require the minimum truck traffic of all of the alternatives. Alternative 4 has the added benefit of localizing the construction of containment systems into just two areas, rather than the widespread construction of caps and covers included in Alternative 3. In addition, both Alternatives 3 and 4 would excavate sediments in Hershey Run. However, Alternative 3 also proposes to construct caps where contamination extends to depth. Alternative 4 does not require capping over widespread areas of the Site, but instead increases the depth of excavation, introducing some difficulties associated with any deeper excavation (e.g., slope stabilization).

Alternative 5 utilizes complex technology that is not widely regarded as proven, and is by no means simple. In addition to a great deal of equipment that would have to be brought in, Alternative 5 would require the most infrastructure to be built at the Site.

Each of the alternatives (besides “no action”) requires construction within a floodplain, which presents several difficulties. Steps must be taken to make sure that, for example, soil or sediment is not washed downstream if an extreme storm event occurs during construction.

In addition, each of the alternatives requires actions to be taken in the wetlands on-site. Numerous difficulties are presented when working in a wetland, specifically related to the prevalence of soft ground and the added difficulty of de-watering all excavated or dredged materials. However, these difficulties are neither unique nor insurmountable.

Cost

The table below summarizes the capital, annual operation and maintenance (O&M), and total present worth costs for all of the alternatives. The total present worth is based on an O&M time period of 30 years for the cap or cover and the NAPL recovery systems. A discount rate of 7% was used in the present worth calculation.

Table 2: Cost Summary

Remedial Alternative	Description	Capital Cost	Present Worth Operations & Maintenance Cost (7%, 30 Yrs)	Total Present Worth Cost
2	Cover upland soils; Sediment cap in Fire Pond, South Pond and K Pond; Sheetpile & NAPL collection at Fire Pond and South Pond; MNR in Hershey Run and tidal wetlands; MNA of ground water contamination	$15,934,988	$1,490,864	$17,425,852
3	Excavate, consolidate and cap shallow soils and shallow tidal sediments; Cap Fire, K and South Ponds; Sheetpile and NAPL collection at Fire Pond and South Ponds areas; Rechannelization of Hershey Run; Wetlands mitigation; MNA of ground water contamination	$40,094,305	$3,250,383	$43,344,688
4	Excavate, consolidate and cap all contaminated soils and sediments; Subsurface ground water barrier wall around consolidation areas with passive NAPL recovery; Restoration of ground water through excavation of NAPL-contaminated aquifer material outside of consolidation areas; Rechannelization of Hershey Run; Wetlands mitigation; Monitoring of ground water contamination	$49,837,587	$1,918,652	$51,756,239
5	In-situ steam-enhanced extraction of subsurface NAPL; excavation and off-site treatment of sediments and certain soils; Wetland restoration; MNA of ground water contamination	$189,365,815	$1,419,957	$190,785,772

The O&M costs may appear high for Alternative 4 due to the inclusion in that alternative of extensive efforts to passively recovery NAPL and manage ground water. For Alternative 5 the O&M costs may appear low due to the inclusion of the operating costs of the *in-situ* steam extraction with the capital cost as part of the alternative. Under the preferred alternative, NAPL recovery would be expected to taper off, which would reduce O&M costs. Alternatives 2 and 3 do not include aggressive efforts to recover NAPL, nor do they include provisions to manage ground water which could build up behind the containment cells and potentially re-contaminate wetlands. The high O&M costs associated with Alternative 3 are largely due to the need to maintain caps and wetlands across a large area for 30 years.

Several points stand out when evaluating the costs. First, there is a large increase in cost between Alternatives 2, 3 and 4 and Alternative 5. Alternatives 2 through 4 are containment remedies. Alternative 5 has been included as representative of a treatment remedy – other treatment remedies were considered in detail in the Feasibility Study. Some treatment remedies were less costly (i.e., solidification/stabilization at approximately $85 million) and others were more costly (i.e., *in-situ* thermally-enhanced extraction of subsurface NAPL combined with excavation and off-site incineration of soils and sediments at approximately $280 million). Second, the preferred alternative, Alternative 4, is approximately $8.4 million more costly than Alternative 3. For this increase in cost, Alternative 4 restores ground water outside the containment area to its beneficial use and consolidates all of the contamination to two areas thus avoiding long-term monitoring of vast areas of wetlands for recontamination.

State Acceptance

DNREC has reviewed and commented on this Proposed Plan. DNREC's acceptance of the preferred alternative will be fully evaluated after the public comment period and will be described in the Record of Decision. As a result of an extensive series of meetings over the past year and a half which resulted in the development of the preferred alternative, the State has expressed a strong interest in providing for an aggressive cleanup of the wetlands and ground water to allow the maximum reuse of the Site, potentially for the creation of wetlands for use as a wetlands bank.

Community Acceptance

Community acceptance of the preferred alternative will be evaluated after the public comment period ends and will be addressed in the Responsiveness Summary in the Record of Decision.

Preferred Alternative

Based on the comparison of the nine criteria summarized previously for each of the alternatives in this Proposed Plan, EPA's preferred alternative is Alternative 4. The total present worth cost of EPA's preferred alternative is $51,760,000. In addition to the common elements described on page 19 (e.g., ground water monitoring and institutional controls), the major components of Alternative 4 (as discussed in detail on page 23) are:

1) Excavate, consolidate and cap contaminated soils and sediments on-site (soils with total PAHs exceeding 600 mg/kg and sediments with total PAHs exceeding 150 mg/kg);

2) Construct a subsurface ground water barrier wall around the on-site consolidation areas to contain creosote and ground water contamination;

3) Conduct passive NAPL recovery inside the consolidation areas;

4) Restore ground water outside of the consolidation areas by excavating and consolidating NAPL-contaminated aquifer material (areas to be excavated will be delineated using both visual and olfactory detection, with post-excavation analysis to confirm that cleanup goals have been met);

5) Rechannelize Hershey Run around the western consolidation area;

6) Mitigate for wetlands lost due to the construction of the western consolidation area; and

7) Conduct long-term monitoring of ground water contamination.

EPA's preferred alternative meets the threshold criteria of overall protection to human health and the environment and compliance with ARARs.[6] Based on the information currently available, EPA (the lead agency) believes Alternative 4 provides the best balance of tradeoffs among the alternatives with respect to the balancing criteria. For example, EPA's preferred alterative:

1) would be protective of both human health and the environment in the least amount of time;

2) would, compared to Alternatives 2 and 5, have significantly less impact to the community during construction; and

3) would be the least costly of the alternatives that provide overall protection to human health and the environment.

Alternative 4 would also offer the highest degree of State acceptance since it would provide for the maximum flexibility in the reuse of the Site. In addition, EPA's preferred alternative would be consistent with EPA's ground water policy and policies pertaining to the removal and/or containment of NAPL. Overall, EPA's preferred alternative would satisfy the statutory requirements of CERCLA §121(b) by being protective of human health and the environment; complying with ARARs; being cost-effective; utilizing permanent solutions and alternative treatment technologies to the maximum extent practicable; and satisfying the preference for treatment as a principal element. EPA's preferred alternative could be modified or changed in response to public comment or new information.

Community Participation

This Proposed Plan is being distributed to solicit public comment on the appropriate cleanup action for the Site. EPA relies on public input so that the remedy selected for each Superfund Site addresses the concerns of the local community. EPA is providing a 30-day public comment period beginning on October 7, 2004 and ending on November 6, 2004, to encourage public participation in the selection process. EPA will conduct a public meeting during the comment period in order to present the Proposed Plan and supporting information, answer questions, and accept both oral and written comments from the public. The public meeting will be held on Thursday, October 21, 2004 at the Peniel United Methodist Church, 115 E. Market St., Newport, Delaware at 7:00 PM.

[6] Note that while each alternative, (other than the "no action" alternative) addresses some of the risks at the Site, the only other alternative to completely meet these threshold criteria was Alternative 5.

EPA will summarize and respond to comments received at the public meeting and written comments post-marked by November 6, 2004 in the Responsiveness Summary section of the Record of Decision, which documents EPA's final selection of a cleanup strategy. To obtain additional information relating to this Proposed Plan, please contact either of the following EPA representatives:

Larry Johnson
Community Involvement Coordinator
U.S. EPA - Region III
1650 Arch Street (3HS43)
Philadelphia, PA 19103
Phone: 215-814-3239
Email: Johnson.Larry-c@epa.gov

Matthew T. Mellon
Remedial Project Manager
U.S. EPA - Region III
1650 Arch Street (3HS23)
Philadelphia, PA 19103
Phone: 215-814-3168
Email: Mellon.Matthew@epa.gov

The detailed Administrative Record can be examined at the following locations:

Kirkwood Public Library
6000 Kirkwood Highway
Wilmington, DE 19808
(302) 995-7663

Delaware Department of Natural Resources & Environmental Control
Superfund Branch
391 Lukens Drive
New Castle, DE 19720
(302) 395-2600

Admin. Records Room
US EPA Region III
1650 Arch Street
Philadelphia, PA 19103
(215) 814-3157
(Please call ahead.)

The Administrative Record can also be viewed on the internet, at http://www.epa.gov/arweb .

Glossary

Administrative Record - EPA's official compilation of documents, data, reports, and other information that is considered important to the status of, and decisions made, relative to a **Superfund Site**. The record is placed in the information repository to allow public access to the material.

Administrative Order on Consent (AOC): A legal agreement between EPA and **potentially responsible parties (PRPs)** whereby PRPs agree to perform or pay for a **Remedial Investigation/Feasibility Study** at a **Superfund** site.

Area of attainment: The area over which ground water cleanup levels must be met. This area generally encompasses the area outside the boundary of any waste or contaminated soil managed in place and up to the boundary of the ground water contaminant plume.

Applicable or Relevant and Appropriate Requirements (ARARs): The federal and state requirements or criteria with which a selected remedy must comply.

Aquifer: A layer of rock or soil that can supply usable quantities of ground water to wells and springs. Aquifers can be a source of drinking water and provide water for other uses as well.

Baseline Risk Assessment ("BRA"): - The BRA is an essential component of the **Remedial Investigation** Report. This portion of the RI evaluates the carcinogenic and non-carcinogenic risks presented by the contaminants at the Site. Risk is calculated both for current uses and potential future uses of the property by a defined population i.e. on- and off-site residents, trespassers, etc.

Bioaccumulation (also known as Biological Magnification): Refers to the process whereby certain substances such as pesticides or heavy metals move up the food chain, work their way into rivers or lakes, and are eaten by aquatic organisms such as fish, which in turn are eaten by large birds, animals or humans. The substances become concentrated in tissues or internal organs as they move up the chain.

Biota: The animal and plant life of a given region.

Carcinogen: A cancer-causing agent.

C.F.R.: The Code of Federal Regulations. For example, the citation 40 C.F.R. 260 means Title 40 of the Code of Federal Regulations, Part 260.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act. The Act created a Trust Fund, known as **Superfund**, to investigate and clean up abandoned or uncontrolled hazardous waste sites.

Consent Decree: A legal agreement between EPA and **potentially responsible parties (PRPs)** which is entered by, and enforceable by, a court.

Ecological Receptors: Plant and animal life that may be exposed to hazardous substances.

***ex-situ*:** Removed from the original place.

Feasibility Study (FS): A report that identifies and evaluates alternatives for addressing the contamination that presents unacceptable risks at a **Superfund** site.

Ground Water: The water beneath the earth's surface that flows through the soil and rock openings and often serves as a source of drinking water.

Hazard Index (HI): A numeric representation of non-cancer risk. A HI exceeding one (1) is considered an unacceptable non-cancer risk.

***in-situ*:** In the original place, e.g., treatment in place.

Institutional Controls: Non-engineered instruments such as administrative and/or legal controls that minimize the potential for human exposure to contamination by limiting land or resource use.

Information Repository A location where documents and data related to the Superfund project are placed by EPA to allow the public access to the material.

Maximum Contaminant Levels (MCLs): Enforceable standards for public drinking water supplies under the Safe Drinking Water Act. These standards apply to specific contaminants which EPA has determined have an adverse effect on human health above certain levels.

Maximum Contaminant Level Goals (MCLGs): Nonenforceable health-based goals for drinking water that are established at levels at which no known or anticipated adverse human health effects occur.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): The federal regulation that provides the organizational structure and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants and contaminants.

National Priorities List (NPL): EPA's list of the nation's top priority hazardous waste sites that are eligible to receive federal money for response under **CERCLA**.

No Observable Adverse Effect Level (NOAEL): An exposure level at which there are no statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control; some effects may be produced at this level, but they are not considered as adverse, or as precursors to adverse effects. In an experiment with several NOAELs, the regulatory focus is primarily on the highest one, leading to the common usage of the term NOAEL as the highest exposure without adverse effects.

Non-Aqueous Phase Liquid (NAPL): Contaminants that remain undiluted as the original bulk liquid in the subsurface, e.g. spilled oil or creosote.

Organic Compound: A chemical comprised primarily of carbon and hydrogen.

Polycyclic Aromatic Hydrocarbons (PAHs): Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot. PAHs occur in abundance in creosote and are also found in coal tar, crude oil, and roofing tar.

Potentially Responsible Parties (PRPs): An individual or company (such as a facility owner or operator, or a transporter or generator of hazardous substances) who may be legally responsible for the clean up of hazardous substances at a Superfund Site. Whenever possible, EPA requires PRPs, through administrative and legal actions, to clean up hazardous waste sites they have contaminated.

Principal Threat: Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. They include liquids and other highly mobile materials (e.g., solvents) or materials having high concentrations of toxic compounds. The NAPL material found at the Koppers Site is considered Principal Threat waste.

ppb: Parts per Billion. Five parts per billion is a fractional representation of 5 parts in 1 billion parts. For solids, ppb is a fraction based on weight, for example 5 pounds of a contaminant in a billion pounds (500,000 tons) of soil. For liquids ppb is based on volume, for example 5 tablespoons of a contaminant in a billion tablespoons (3,906,250 gallons) of water. A ppb is a much smaller quantity than a **ppm**.

ppm: Parts per Million. Five ppm is a fractional representation of 5 parts in 1 million.

RCRA (Resource Conservation and Recovery Act):- A federal law that established a regulatory system to track hazardous substances from the time of generation to disposal. The law requires safe and secure procedures to be used in treating, transporting, storing and disposing of hazardous substances.

Record of Decision (ROD): A legal document that describes the remedial actions selected for a Superfund Site, why certain remedial actions were chosen as opposed to others, and how much they will cost. It summarizes the results of the **Remedial Investigation/Feasibility Study** reports and the comments received during the comment period for the Proposed Plan.

Remedial Action (RA): The actual construction or implementation phase of a Superfund Cleanup following a **Remedial Design** (RD).

Remedial Design (RD): The period during which the engineering drawing and specifications for the selected remedy are prepared.

Remedial Investigation (RI): A study which identifies the nature and extent of contamination at a **Superfund** site and forms the basis for the evaluation of environmental and human health risks posed by the site.

Remedial Investigation and Feasibility Study (RI/FS): A report composed of two scientific studies, the RI and the FS. The RI is the study to determine the nature and extent of contaminants present at a Site and the problems caused by their release. The FS is conducted to develop and evaluate options for the cleanup of a Site.

Resource Conservation and Recovery Act (RCRA): A federal law that established a regulatory system to track hazardous substances from the time of generation to disposal. The law requires safe and secure procedures to be used in treating, transporting, storing and disposing of hazardous substances.

Risk Assessment: Qualitative and quantitative evaluation of the risk posed to human health and/or the environment by the actual or potential presence and/or use of specific pollutants.

Semivolatile Organic Compound: An **organic compound** that, at a relatively low temperature, fluctuates between a vapor state (a gas) and a liquid state.

Superfund: The common name used for **CERCLA**.

Sediments: Soils, sand and minerals washed from land into water.

TBC: “To Be Considered” - If not legally **Applicable or Relevant and Appropriate Requirement (ARAR)** it is nevertheless useful information *to be considered* in developing remedial alternatives.

Vadose Zone: The soil above the **water table**.

Volatile Organic Compound (VOC): An **organic compound** that readily evaporates (volatilizes) under atmospheric conditions.

Volatilization: The transition of a chemical from a liquid state to a gaseous state.

Water Table: The point below the surface of the soil where free standing water exists. This water is referred to as ground water.